

sional rotation. We are justified in assuming that this free precessional period is constant in duration and therefore determines the average rate of rotation of the pole of revolution. If, therefore, we take a diagram of the polar movement, which will naturally have its axes of reference fixed in relation to the earth, and convert it into another diagram, showing the same movement, referred to axes rotating in the earth at the average rate of the precessional rotation, we obtain a graph of the irregular part of the polar path. If this irregular part has any well-marked annual period, such period ought to be apparent on inspection of the converted diagram. In the actual diagrams obtained there seems little or no evidence of the existence of a yearly term.

We now take the second diagram, and by the well-known process construct its hodograph, the curve which gives us a measure of the amount and direction of the force which could have caused the movement recorded in diagram No. 2. This will still be referred to the moving axes, so is not directly available for deducing the true direction of these forces in the earth. Before we can do this we must refer the diagram back again to axes fixed in the earth. Thus, finally, we obtain our diagram No. 4, which may be called the torque diagram, as it represents in direction and relative magnitude the torque or twisting force which has been acting upon the earth to produce the observed movement of the pole.

The interpretation of such a diagram is a somewhat complex matter, and has not yet advanced far. The causes that seem to be at work producing the irregular shift are either movements of the earth's crust, slow or rapid, as in an earthquake; the transfer of Arctic ice from one point to another, or its accumulation and disappearance so far as this takes place unsymmetrically with respect to the earth's axis; and possibly extensive barometric changes extending over considerable areas.

Of these the transfer of ice is the largest factor and is probably the one to which most of the irregular polar movement may be ascribed. An earthquake, even of gigantic dimensions, would have an almost negligible effect. The late Prof. Milne estimated that a very large earthquake might displace ten million cubic miles of earth through a distance of 10 ft. horizontally or vertically. Such a vast cataclysm would only change the position of the pole by a few inches.

In conclusion it will be an act of natural curiosity to inquire whether there is any evidence of the amplitude of these polar wanderings having been greater in past times than at present, and whether there is any likelihood of their being greater in the future. To both these questions the answer is "No." The axis of rotation is always kept near the axis of figure by internal friction, and it would require a large change in the distribution of mass to move the axis of figure very far.

As regards the future, the probabilities point still more strongly in the same direction. Each shrinkage of the earth, whatever its immediate effect on the position of the axis of rotation may be, tends ultimately to bring it nearer to the axis of figure or principal axis of inertia, and therefore tends to reduce the average amplitude of the polar path. The distance of the pole of rotation from the mean pole will therefore gradually decrease as the world grows older, while at the same time, as the earth cools and becomes less elastic and more rigid, the rate of rotation will quicken.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE Marquess of Crewe has been appointed President of the Board of Education, in succession to Mr. Arthur Henderson, resigned.

THE honorary degree of doctor of laws has been conferred upon Dr. Otto Klotz, of the Dominion Astronomical Observatory, Ottawa, by the University of Pittsburgh.

AN explanatory circular respecting the programme for technical schools and classes for the session 1916-17 has been issued by the Department of Agriculture and Technical Instruction for Ireland. The regulations which were in operation during the session 1915-16 will continue in force with some few alterations, among which we note that a school will not be recognised as a technical school under the conditions of section ii. (a) of the programme unless there are at least twenty approved introductory and specialised course students in attendance in any session, of whom not less than 50 per cent. are specialised course students. Teachers recognised for grants under the conditions of the third paragraph of the explanatory circular will not be recognised for this purpose as specialised course students. The case of schools of a special character will receive special consideration, and, if it is thought desirable, this regulation may be modified in the case of such schools. Grants will not be paid upon the attendance of a student at more than one lesson in the same syllabus on the same day, unless there is an interval of at least 15 min. between each lesson. Instruction in the first-year syllabus of a subject of a specialised course will not be permitted to be given concurrently by the same teacher with instruction in any other syllabus or subject.

A REPORT on Indian education, 1914-15, by Mr. Sharp, educational commissioner with the Government of India, has recently been received. The report is a very brief narrative of the main lines of Indian educational progress, and consists of twenty-seven pages (quarto) of letterpress and fifty-seven pages of tables. In addition, something like fifty interesting illustrations are given of educational buildings of different grades and classes which have been completed during the twelve months under review, and of the arrangements in such buildings. When it is considered that all forms of education are dealt with, from university standards down to primary schools, with an area about fifteen times as large as the United Kingdom, with a number of pupils of between seven and eight millions, and at a cost of eleven crores of rupees (that is, more than 7,200,000*l.*), it will be understood that a volume of the size mentioned represents almost the utmost limits of condensation. The effects of the war in Europe have been very distinctly felt in India, in the first place, in the desirability for economy, though even here it was found that the expenditure for the year under review was about 90 lakhs (nearly 600,000*l.*) higher than in the year previous to the war. The increase appears to have been mainly due to the rapidly increasing number of pupils in the schools, etc.; for in the five years up to 1914 the numbers had increased by no fewer than one and a third million pupils. The war, however, has affected the higher educational institutions more than the lower, for a good many of the British professors in colleges, etc., are now on military service. It is noticeable that pamphlets, such as "Why Britain is at War" and others, have been widely distributed in several of the Indian vernaculars to pupils. Also other means, such as lectures, etc., have been taken

to put the war in its proper light. On the other hand, though it was known that Germany had long maintained a regular organisation of propagandist schools throughout the world, it was not until July, 1915, that steps were taken by the Government of India to intern or repatriate the enemy aliens in India who were engaged in school work, when such schools were handed over to other agencies.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, August 7.—M. Paul Appell in the chair. **C. Richet**: The monthly variation of natality. For a period of fifty-seven years the maximum number of births is in February or March. For the years 1906–10 the maximum in these two months is shown in all countries in the Northern Hemisphere, and figures for eleven countries are cited. In the Southern Hemisphere the monthly maximum is in August–October, or a period six months from the maximum in the Northern Hemisphere. The maxima are in the same months both for legitimate and illegitimate births, for rural and urban populations, for the poor and rich; but a relation can be traced between the latitude and the date of the monthly maximum.—**C. Camichel**: Hammering in water mains: the examination of the state of a main. **P. Choffat**: The volcanic intrusive rocks of the region situated to the north of the Tagus.—**E. Belot**: Experimental volcanoes and the laws of volcanic phenomena. The experimental arrangement described in an earlier communication can be modified by the introduction of a layer impermeable to water and steam (slate) above the source of heat.—**R. Souèges**: The first divisions of the egg, and the origin of the hypophysis in *Capsella bursa-pastoris*.

BOOKS RECEIVED.

Théorie Générale des Nombres: Définitions fondamentales. By E. Dumont. Pp. 92. (Paris: Gauthier-Villars et Cie.) 2 francs.

Petit Atlas Céleste. By G. Bigourdan. Pp. 57. (Paris: Gauthier-Villars et Cie.) 2 francs 75 centimes.

Le Climat de la France: Température, Pression, Vents. By G. Bigourdan. Pp. 135. (Paris: Gauthier-Villars et Cie.) 4 francs.

Mitteilungen der Naturforschenden Gesellschaft in Bern. 1913. Pp. xxxv+266. 1914. Pp. xxv+324. 1915. Pp. 1+315. (Bern: K. J. Wyss.)

Centenaire de la Société Helvétique des Sciences Naturelles. Band I. Pp. vi+316. (Basel: Georg and Co.)

Neue Denkschriften der Schweizerischen Naturforschenden Gesellschaft. Band II. (Basel: Georg and Co.)

Actes de la Société Helvétique des Sciences Naturelles, 97me Session. 2 Pts. (Aarau: H. R. Sauerländer et Cie.)

Verhandlungen der Schweizerischen Naturforschenden Gesellschaft, 1914. 2 Pts. (Aarau: H. R. Sauerländer et Cie.)

The Sea-Trout. By H. Lamond. Pp. xi+219. (London: Sherratt and Hughes.) 21s. net.

Observations made at the Royal Magnetical and Meteorological Observatory at Batavia. Vol. xxxv. (1912.) Pp. xxvi+96. *Observations made at Secondary Stations in Netherlands East-India.* Vol. iii.

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(1913.) Pp. ix+119. (Batavia: Government Printing Office.)

Results of Registering-Balloon Ascents at Batavia. By Dr. W. van Bemmelen. Pp. lvii+109. (Batavia: Javasche Boekhandel en Drukkerij.)

Regenwaarnemingen in Nederlandsch-Indië. Zes en Dertigste Jaargang, 1914. Deel II. Uitkomsten. Pp. ix+230. (Batavia: Landsdrukkerij.)

Océanographische Waarnemingen in den Indischen Oceaan, Sept., Oct., Nov. (1856–1914). Tabellen: *Observations Océanographiques et Météorologiques dans l'Océan Indien.* Pp. xi+240; Kaarten 25. (Utrecht: Versluys and Scherjon.) Text and atlas, 6.50 florins.

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